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(54) **SYSTEM AND METHOD FOR REPRESENTING MFS CONTROL BLOCKS IN XML FOR MFS-BASED IMS APPLICATIONS**

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See application file for complete search history.

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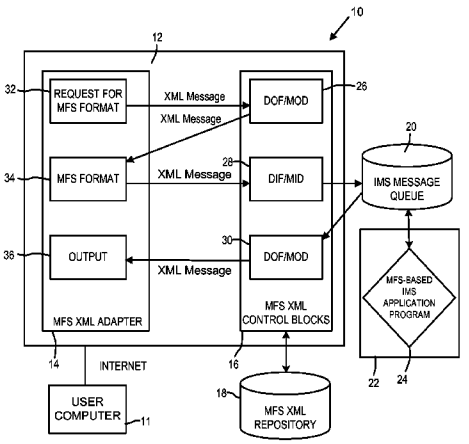
(57) **ABSTRACT**

A system and method for representing MFS control blocks in XML for MFS-based IMS applications utilizes an MFS XML adapter and an MFS XML repository to translate between XML and MFS. The repository contains XML files for DOF/MOD and XML files for DIF/MID. When an XML request is received, the XML request is transformed to a byte stream by retrieving the relevant information from the MFS XML repository. The byte stream can then be placed in an IMS message queue to await processing by an MFS-based IMS application program. A byte stream response is generated by the MFS-based IMS application and is transformed into an XML response, again, by retrieving the relevant information from the MFS XML repository.

3 Claims, 3 Drawing Sheets



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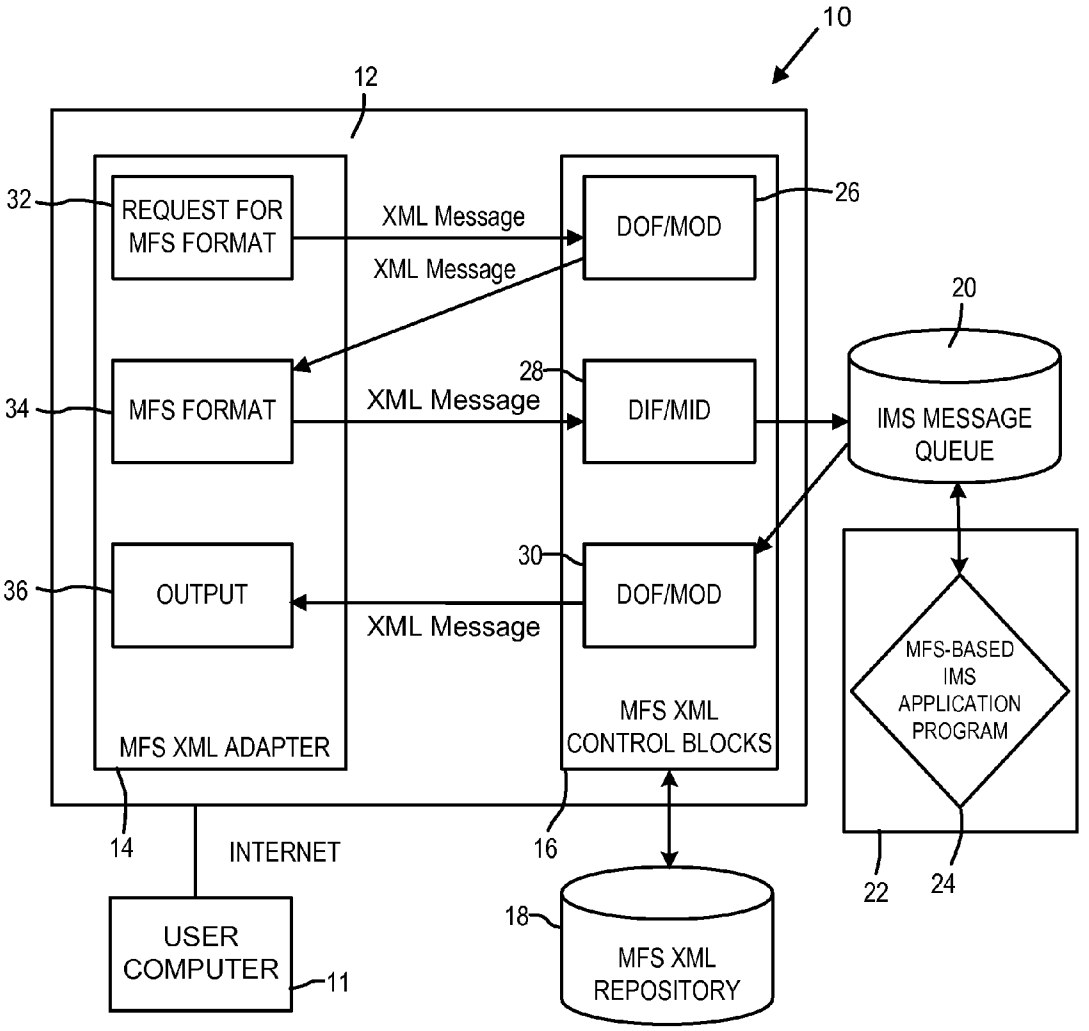
10
12
32
REQUEST FOR MFS FORMAT
XML Message
DOF/MOD
26
XML Message
20
28
34
MFS FORMAT
XML Message
DIF/MID
IMS MESSAGE QUEUE
30
36
OUTPUT
DOF/MOD
XML Message
MFS-BASED IMS APPLICATION PROGRAM
MFS XML CONTROL BLOCKS
MFS XML ADAPTER
14
16
INTERNET
22
24
18
USER COMPUTER
11
MFS XML REPOSITORY

Fig. 1

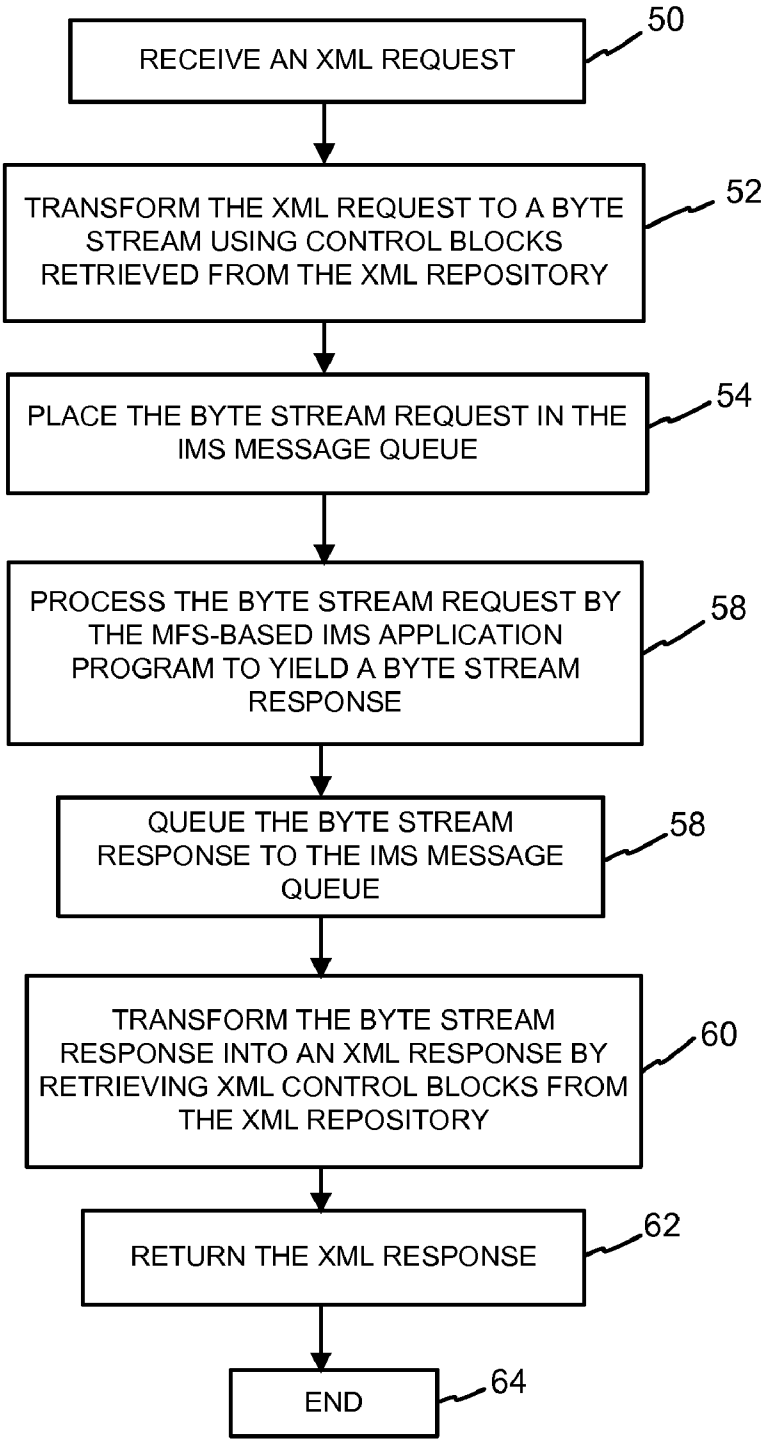
RECEIVE AN XML REQUEST
50
TRANSFORM THE XML REQUEST TO A BYTE STREAM USING CONTROL BLOCKS RETRIEVED FROM THE XML REPOSITORY
52
PLACE THE BYTE STREAM REQUEST IN THE IMS MESSAGE QUEUE
54
PROCESS THE BYTE STREAM REQUEST BY THE MFS-BASED IMS APPLICATION PROGRAM TO YIELD A BYTE STREAM RESPONSE
58
QUEUE THE BYTE STREAM RESPONSE TO THE IMS MESSAGE QUEUE
58
TRANSFORM THE BYTE STREAM RESPONSE INTO AN XML RESPONSE BY RETRIEVING XML CONTROL BLOCKS FROM THE XML REPOSITORY
60
RETURN THE XML RESPONSE
62
END
64

Fig. 2

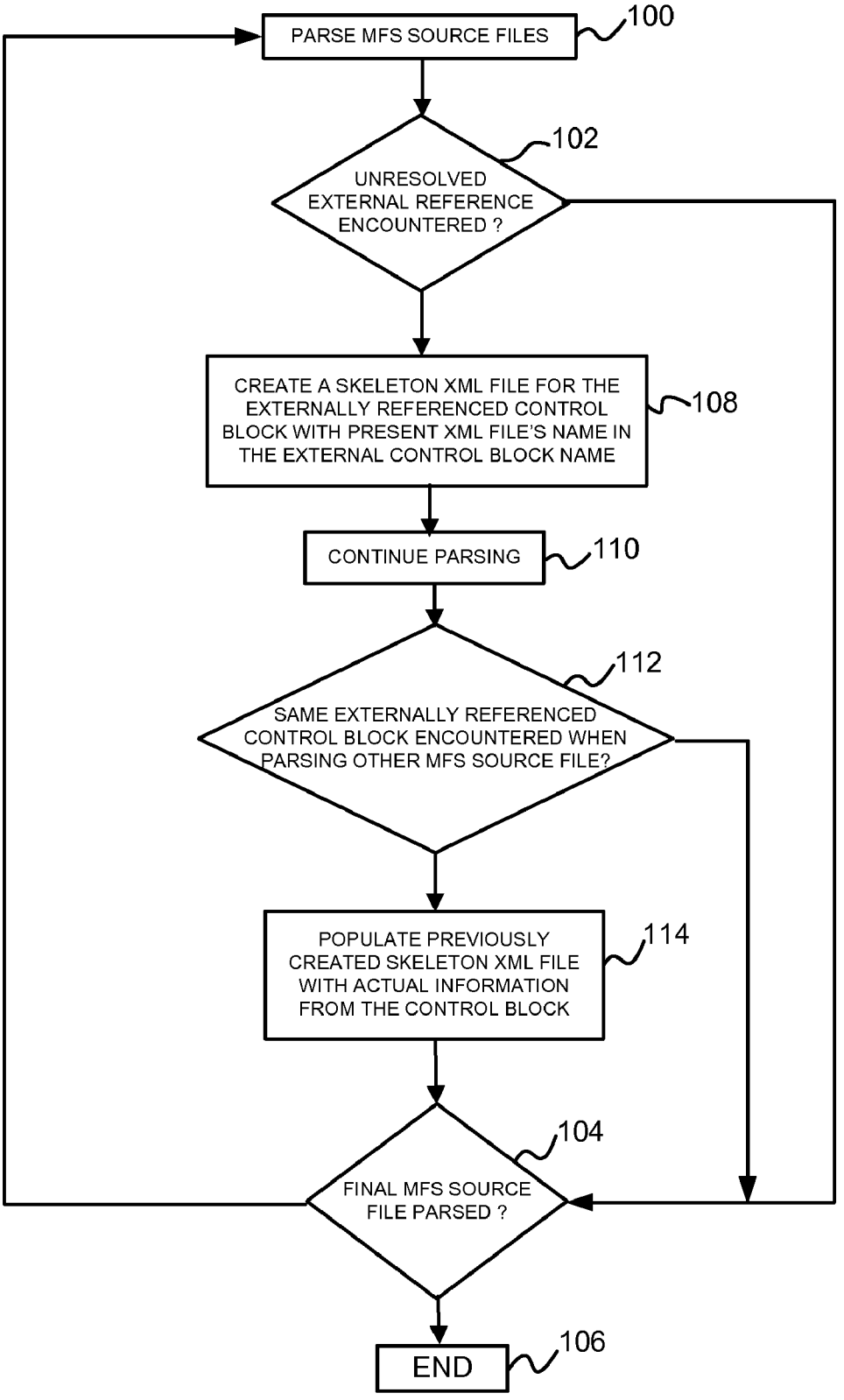
PARSE MFS SOURCE FILES
100
UNRESOLVED EXTERNAL REFERENCE ENCOUNTERED ?
102
CREATE A SKELETON XML FILE FOR THE EXTERNALLY REFERENCED CONTROL BLOCK WITH PRESENT XML FILE'S NAME IN THE EXTERNAL CONTROL BLOCK NAME
108
CONTINUE PARSING
110
SAME EXTERNALLY REFERENCED CONTROL BLOCK ENCOUNTERED WHEN PARSING OTHER MFS SOURCE FILE?
112
POPULATE PREVIOUSLY CREATED SKELETON XML FILE WITH ACTUAL INFORMATION FROM THE CONTROL BLOCK
114
FINAL MFS SOURCE FILE PARSED ?
104
END
106

Fig. 3

SYSTEM AND METHOD FOR REPRESENTING MFS CONTROL BLOCKS IN XML FOR MFS-BASED IMS APPLICATIONS

This application is a continuation of U.S. application Ser. No. 11/494,017, filed Jul. 12, 2006, now U.S. Pat. No. 7,383,322, which is a continuation of U.S. application Ser. No. 10/440,779, filed May 19, 2003, now U.S. Pat. No. 7,130,893.

FIELD OF THE INVENTION

The present invention relates generally to computer software, and more specifically to IMS software.

BACKGROUND OF THE INVENTION

By some estimates, nearly seventy percent (70%) of corporate data in the United States and abroad resides on mainframe computers, e.g., S/390 mainframes manufactured by International Business Machines. Moreover, business-to-business (B2B) e-commerce is expected to grow at least five times faster than the rate of business-to-consumer (B2C) e-commerce. Many transactions involving this corporate data can be initiated by Windows/NT servers, UNIX servers, and other servers but the transactions must be completed on the mainframe using existing legacy applications residing thereon.

One very crucial group of legacy applications are the message format service-based information management system applications ("MFS-based IMS applications") on which many businesses depend heavily. MFS is a facility of the IMS transaction management environment that formats messages to and from many different types of terminal devices. As businesses upgrade their technologies to exploit new B2B technologies, there is a requirement for an easy and effective method for upgrading existing MFS applications to include e-business capabilities. One such e-business capability is the ability to send and receive MFS-based IMS transaction messages as extensible markup language (XML) documents.

The MFS language utility compiles MFS source code, generates MFS control blocks in a proprietary format and uses the control blocks to indicate to an IMS application how input and output messages are formatted. For input messages, MFS control blocks define how a message that is to be sent by a device or remote program is mapped to an application program's input/output (I/O) area. For output messages, MFS control blocks define how the message to be sent by the application program is mapped to the device's screen or the remote program. The MFS control blocks are compiled off line from the MFS source files and are stored in the host format library by the MFS language utility.

Currently, there are four types of MFS control blocks that are used to map input and output messages between an MFS-based application program and a displayable device or remote program. Message Output Descriptors (MODs) describe the layout of the output messages that are received from an MFS-based application program. Device Output Formats (DOFs) described how MFS on-line processing formats output messages for each of the devices or remote programs with which the application communicates. Device Input Formats (DIFs) describe the formats of input messages that MFS on-line processing receives from each of the devices or remote programs with which the application communicates. Message Input Descriptors (MIDs) described how MFS on-line processing further formats input messages so that the application program can process them.

As business processes are updated to exploit new B2B technologies, there is a requirement to support B2B interchanges. However, MFS control blocks are presently coded in an IBM proprietary language format and there does not exist any way to represent MFS control blocks in XML to format XML input and output messages between MFS-based IMS applications and displayable devices, e.g., PDA or Web browsers, or remote programs. Also, it is currently problematic to save and load XML files without the existence of external references.

A non-proprietary, industry-wide standard method is needed to represent the information in today's MFS control blocks. It happens that XML is growing in acceptance as the universal data format which can be the input and output for any application. If the MFS control blocks are represented in XML, they can easily be used for developing new software to map XML messages for IMS MFS transaction applications. Using MFS control blocks in XML can encourage a wide range of connection types and tools to be developed and provide a simple and unified way to re-use existing MFS-based IMS transaction applications.

Accordingly, there is a need for a system and method for representing MFS control blocks in an industry-wide standard format. Moreover, there is a need for a system and method for allowing references to external XML files containing MFS control blocks from within a given XML file without having the external XML files present and/or created.

SUMMARY OF THE INVENTION

A method for representing MFS control blocks in XML for MFS-based IMS applications includes establishing an MFS XML repository. Plural XML files representing plural MFS control blocks are stored in the MFS XML repository. Preferably, an XML request is transformed into a byte stream request based on the XML files within the MFS XML repository. The byte stream request can be processed by an MFS-based IMS application program to yield a byte stream response. Again, based on the XML files within the repository, the byte stream response is transformed into an XML response.

In a preferred embodiment, a first MFS source file is parsed and it is determined whether an unresolved external reference is encountered while parsing the first MFS source file. Based on the determination, a skeleton XML file for an externally reference control block is created. The skeleton XML file can include a present file name in the external control block name. Further, in a preferred embodiment, a second MFS source file is parsed and it is determined whether a previously encountered externally referenced control block is again encountered while parsing the second MFS source file. Based on the determination, a previously created skeleton XML file can be populated with information from the control block.

In another aspect of the preferred embodiment of the present invention, a system for representing MFS control blocks in XML for MFS-based IMS applications includes an MFS XML adapter and an MFS XML repository connected thereto. The MFS XML repository includes plural XML files that represent plural MFS control blocks. The system further includes a computer program for representing MFS control blocks in XML for MFS-based IMS applications. In this aspect, the computer program includes logic means that can transform an XML request into a byte stream request based on the XML files in the MFS XML repository.

In yet another aspect of the preferred embodiment of the present invention, a computer program device for representing MFS control blocks in XML for MFS-based IMS appli-

cations includes logic means for receiving an XML request and logic means for transforming the XML request into a byte stream. Further, the computer program device includes logic means for placing the byte stream request in an IMS message queue.

The preferred embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram representing the present invention;

FIG. **2** is a flow chart of the overall logic of the present invention; and

FIG. **3** is a flow chart of the MFS source file parsing logic.

DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

Referring initially to FIG. **1**, a block diagram of the system for facilitating XML transactions with MFS-based IMS applications is shown and is generally designated **10**. FIG. **1** shows that the system **10** includes a user computer **11** connected, e.g., via the Internet to a first server **12**. Within the first processor **12**, is an MFS XML adapter **14** that communicates with MFS XML control blocks **16** that are retrieved from an MFS XML repository **18**. In a preferred embodiment, the MFS XML adapter **14** is the software-implemented MFS XML adapter that is executed within the first processor **12** and that is discussed in U.S. patent application Ser. No. 10/244,722, incorporated herein by reference. It is to be understood that the MFS XML adapter **14** includes a mapper which maps the XML document pertaining to the device information into the appropriate MFS XML messages (and vice versa). Also, the MFS XML adapter **14** includes a converter that transforms the MFS XML messages into a byte stream and vice versa. The MFS importer reads and parses MFS source files for a particular application and generates XML files that describe the MFS-based application interface using the MFS Metamodel discussed in U.S. patent application Ser. No. 09/849,105, incorporated herein by reference, which is part of the Common Application Metamodel (CAM) disclosed in U.S. Provisional Application Ser. No. 60/223,671, also incorporated herein by reference.

FIG. **1** shows that the MFS XML adapter **14** communicates with an IMS message queue **20** which, in turn, communicates with a second server **22** that hosts an MFS-based IMS application program **24**. An MFS-based IMS application program **22** can, e.g., be a program for tracking inventory. Further, as shown in FIG. **1** and stated above, the MFS XML adapter **14** communicates with the MFS XML repository **18** in order to retrieve the necessary XML control blocks **16** for message formatting. Preferably, a first XML control block for DOF/MOD **26**, an XML control block for DIF/MID **28**, and a second XML control block for DOF/MOD **30** are retrieved from the MFS XML repository **18**. Moreover, as described in detail below, the MFS XML adapter **14** provides a request for MFS format **32** to the MFS XML repository **18**. The MFS adapter **14** retrieves an MFS format **34** from the MFS XML repository **18** and later returns the output **36**.

It can be appreciated that the present invention groups MID and DIF files together as one XML control block and groups MOD and DOF files together as another control block. These groupings reduce the load time of XML files during execution. Moreover, the generated XML files for MFS control blocks can be stored in the MFS XML repository **18**, as described above. Unlike the existing MFS format library, which must be closely coupled to the host processor where the MFS-based IMS application **24** resides, the MFS XML repository **18** containing the MFS control blocks in XML does not have to be tied to the same host processor in which the MFS-based IMS application **24** resides. The MFS XML repository **18** can reside in any processor, including a Windows-based processor, in which the MFS XML Adapter **14** resides. A local file system, or a database repository, e.g., DB2's XML repository, or an z/OS partitioned data set can be used as the MFS XML repository **18**.

It is to be understood that in the system **10** described above, the logic of the present invention can be contained on a data storage device with a computer readable medium, such as a computer diskette. Or, the instructions may be stored on a magnetic tape, hard disk drive, electronic read-only memory (ROM), optical storage device, or other appropriate data storage device or transmitting device thereby making a computer program product, i.e., an article of manufacture according to the invention. In an illustrative embodiment of the invention, the computer-executable instructions may be lines of C++ compatible code.

The flow charts herein illustrate the structure of the logic of the present invention as embodied in computer program software. Those skilled in the art will appreciate that the flow charts illustrate the structures of computer program code elements including logic circuits on an integrated circuit, that function according to this invention. Manifestly, the invention is practiced in its essential embodiment by a machine component that renders the program elements in a form that instructs a digital processing apparatus (that is, a computer) to perform a sequence of function steps corresponding to those shown.

Referring now to FIG. **2**, the overall logic of the present invention is shown and commences at block **50** wherein an XML request is received, e.g., at the MFS XML adapter **14** (FIG. **1**), from the user computer **11**. At block **52**, the XML request is transformed to a byte stream by using the XML control blocks **16** retrieved from the MFS XML repository **18** (FIG. **1**). It is to be understood that in an exemplary, non-limiting embodiment the XML request is transformed as follows: a request for MFS format **32** (FIG. **1**), in XML, is submitted by the MFS XML adapter **14** to the MFS XML repository **18** (FIG. **1**). An XML control block for DOF/MOD **26** (FIG. **1**) is retrieved to generate the MFS format **34** (FIG. **1**) in XML. To complete the request, data is input to the MFS format **34** (FIG. **1**) and the complete request is processed by the MFS XML adapter **14** (FIG. **1**), again, in XML. An XML control block for DIF/MID **28** (FIG. **1**) is used to format the XML request with the proper input format to yield a byte stream message.

Moving to block **54**, the byte stream is placed in the IMS message queue **20** (FIG. **1**). At block **56**, the byte stream is processed by the MFS-based IMS application program **24** (FIG. **1**) to yield a byte stream response. Continuing to block **58**, the byte steam response is queued to the IMS message queue **20** (FIG. **1**). Next, at block **60**, the byte stream response is transformed into an XML response by retrieving the control blocks from of the MFS XML repository **18** (FIG. **1**). For example, the byte stream request is returned to the MFS XML adapter **14** (FIG. **1**) where an XML control block for DOF/MOD **30** (FIG. **1**) is used to determine the format of byte stream request in order to generate an XML response message. Returning to the description of the logic, the XML response message is returned, e.g., to the MFS XML adapter **14** (FIG. **1**) and then the user computer **11**. The logic then ends at state **64**.

It is to be understood that XML files containing MFS control blocks represent all of the application interface information encapsulated by the MFS source—including the input and output messages, display information, MFS flow control, device characteristics and operation semantics. From these types of XML files, the MFS XML adapter **14** (FIG. **1**) maps XML messages into the proper format for MFS-based IMS applications. Thus, MFS-based IMS applications can be retargeted to support B2B XML communications without changing the IMS transaction itself. Additionally, a variety of displayable devices not yet supported by MFS, including web browsers, can be supported.

Another aspect of the present invention is to reference non-existent information across different MFS source files. When an MFS control block is represented as an XML file, a forward reference problem occurs in generating XML for these control blocks because XML files, when loaded or saved, require external references to exist. However, this is not always possible or convenient. For example, when generating an XML file containing a MID control block from an MFS source file, the MID statement often has a reference to a MOD defined in another MFS source file. The external reference to the MOD must be recorded. However, this is not possible within XML unless this external reference already exists, which would require creating an XML file out of the external MOD before creating an XML file out of the MID. In the case in which an external MOD points to a MID which, in turn, points back to the original MOD, the XML file containing the control blocks cannot be generated because of the circular condition.

One possible solution to solve this forward reference problem in XML is to combine all original MFS sources into one large file for XML creation. Unfortunately, since most companies often have thousands of MFS source files, this is not feasible. Also, if one MFS file is changed, it requires regeneration of all XML files for all of the control blocks.

Referring to FIG. **3**, the MFS source file parsing logic, including the solution to the above-mentioned forward reference problem, is shown and commences at block **100**. At block **100**, MFS source files are parsed. Moving to decision diamond, it is determined whether an unresolved external reference has been encountered. If not, the logic moves to decision diamond **104** where it is determined whether the final MFS source file has been parsed. If the final MFS source file has been parsed, the logic ends at state **106**. Otherwise, the logic returns to block **100** and continues as described above.

Returning to decision diamond **102**, if an unresolved external reference has been encountered, the logic moves to block **108** where a skeleton XML file is created for the externally referenced control block with the present XML file's name in the external control block name. Thereafter, at block **110** the parsing of MFS source files continues. Proceeding to decision diamond **112**, it is determined whether the same externally referenced control block has been encountered when parsing another MFS source file. If not, the logic moves to decision diamond **104** and continues as described above. Otherwise, the logic continues to block **114**, where the previously created skeleton XML file is populated with actual information from the control block, and no changes are necessary to the flies which referenced them. The logic then moves to decision diamond **104** and continues as described above.

It can be appreciated that this invention satisfies the external references in an given XML file by generating skeleton XML files as place holders with the appropriate filenames and empty top-level entity. Therefore, reloading existing XML files to check if they have potential references to newly generated XML files is not required.

With the configuration of structure described above, it is to be appreciated that system and method described above provides a means for representing MFS control blocks in an industry-wide standard format. Moreover, it provides a system and method for allowing references to external XML files containing MFS control blocks from within a given XML file without having the external XML files present and/or created.

While the particular SYSTEM AND METHOD FOR REPRESENTING MFS CONTROL BLOCKS IN XML FOR MFS-BASED IMS APPLICATIONS as herein shown and described in detail is fully capable of attaining the above-described aspects of the invention, it is to be understood that it is the presently preferred embodiment of the present invention and thus, is representative of the subject matter which is broadly contemplated by the present invention, that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly to be limited by nothing other than the appended claims, in which reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described preferred embodiment that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the present claims. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it is to be encompassed by the present claims. Furthermore, no element, component, or method step in the present disclosure is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. No claim element herein is to be construed under the provisions of 35 U.S.C. section 112, sixth paragraph, unless the element is expressly recited using the phrase "means for."

We claim:

1. A system for representing MFS control blocks in XML for MFS-based IMS applications, comprising:

an MFS XML adapter;

an MFS XML repository connected to the MFS XML adapter, the MFS XML repository including at least one XML file representing at least one MFS control block;

a computer program for representing MFS control blocks in XML for MFS-based IMS applications, the computer program comprising: logic means for transforming an XML request into a byte stream request at least partially based on the MFS control block within the MFS XML repository; wherein the XML file is at least one of the following: an XML file for device output format/message output descriptors (DOF/MOD) and an XML file for device input format/message input descriptors (DIF/MID), and wherein the computer program further comprises:

logic means for processing the byte stream request with an MFS-based IMS application program to yield a byte stream response;

logic means for transforming the byte stream response into an XML response at least partially based on the files in the MFS XML repository;

logic means for parsing an first MFS source file; and

logic means for determining whether an unresolved external reference is encountered while parsing the first MFS source file.

2. The system of claim **1**, wherein the computer program further comprises:

logic means for parsing a second MFS source file; and

logic means for determining whether a previously encountered externally referenced control block is again encountered while parsing the second MFS source file.

3. A computer program device for representing MFS control blocks in XML for MFS-based IMS applications, comprising:

logic means for establishing an MFS XML repository having at least one XML file representing at least one MFS control block;

logic means for transforming an XML request into a byte stream request at least partially based on the XML file;

logic means for parsing a first MFS source file; and

logic means for determining whether an unresolved external reference is encountered while parsing the first MFS source file.

* * * * *